Dear Sir—I. L. Stefani may well describe his pleas for rejecting the results of the IEC's seven-year stint on circuit conventions as urgent, since it comes seven months after mine (Jan. 1970 *E & P*, p. 27). (Incidentally, during the interval no one seems to have countered the criticisms.) While Mr. Stefani and I thus happily agree in our opposition to the IEC proposals, and he gives a qualified approval of my current notation (though he somewhat obscures its origin), his own 'master' set of conventions provokes some questions.

To him it is 'obvious that plus and minus signs must be acceptable as a p.d. convention'. To me it is obvious that they are unacceptable. Although the major part of his letter emphasises the importance of conventions being universal and suitable for all branches of electrical engineering (and with this I heartily agree), he warns of the possibility of ambiguity if the plus and minus signs are used for circuits with more than two or three nodes. This may be compared with the system advocated in my book 'Phasor diagrams', in which there is no risk of ambiguity with any reasonable number of nodes; an example with ten nodes is given.

Moreover, this system does appear to be suitable for all branches of electrical engineering, and for circuits (such as transistor circuits) generally regarded as too difficult to attempt with phasor diagrams. Secondly, it may not be obvious to the student why plus and minus signs should be appropriate for a.c. circuits, where simple positive and negative are not enough and are likely to confuse, e.g. with quadrature relationships. Thirdly—and this point embraces all three voltage conventions shown by Mr. Stefani, where he labels one side as 'node having the higher potential'—in general it is not known which terminal of a circuit element has the higher potential with reference to the other.

That, in fact, may be what one is attempting to find out. Plus and minus signs or arrows confuse by prejudging this issue. The double-subscript conventions (nodes for voltage; meshes for current) do not; they merely indicate which letter marks the reference node or mesh, and the voltage or current so designated may turn out to be (in d.c. circuits) positive, negative or zero, and in a.c. circuits to have any phase angle relative to the chosen phase angle.

Although distinguishing between e.m.f. and potential difference is necessary and desirable at some stages of electrical-engineering education, for general circuit purposes (and particularly in Kirchhoff's voltage law) this practice is responsible for more anomalies, contradictions, diversities and general confusion in electrical-engineering textbooks than perhaps any other. Instead of it being necessary to begin by classifying voltages into V and E, this distinction emerges from the relevant phasor diagram, if it is drawn strictly according to double-subscript conventions—and no others are needed.

I am rather puzzled by Mr. Stefani's first paragraph in the third column, on current notation. One might gather from it that an unspecified number of persons had made 'attempts' to dualise the nodal lettering of voltage phasors, and that these had led to a 'Bow's notation', which I developed. In the first place, it is a well known fact that the dual of a node is a mesh; so, if a node-subscript convention is accepted for voltages, the appropriate one for currents is a mesh-subscript convention. It is as simple as that; so 'attempts' did not enter into it.

But the obvious often eludes observation, and it is a perpetual source of surprise to me that no one has come forward to claim this glimpse of it before mine. I owe nothing to Bow; the analogy with his notation for structures occurred to me later, and I mentioned it as a matter of interest and to emphasise my surprise that for so long no one had thought of using the corresponding notation for currents. I owe more to Maxwell, for he appears to have been the first to identify currents by the meshes they flowed around, but as far as I know he did not go on to use a double-subscript notation to identify currents in branches.

By the way, Mr. Stefani uses capital letters for nodes (which are infinitesimally small) and small letters for meshes (which are usually the largest things in the circuit diagram). Why? This may seem a trivial point, but it is of just the kind that makes things a little more difficult for the student. A great advantage of an easily remembered convention (small letters refer to small things—nodes—and therefore to voltages) is that the letters V and I can be omitted and the subscripts brought up to the line. AB, for example, then fully identifies a particular current and its phasor.

Mr. Stefani considers that this current notation, in spite of its being 'somewhat restricted in application', 'would appear to be well worth retaining as a secondary standard'. I would like to ask him why, then, it is the only current-identifying notation shown in his 'master' set. What primary standard does he propose? And what are the restrictions that put the mesh notation in the secondary class? Incidentally, I am not clear how one deduces his version of the mesh convention from his diagram. What does E_b signify, and which positive direction of I_{ab} is to be inferred?

Finally, since like me he favours a set of conventions 'carefully selected for universal application', can he show in what respects those set forth in 'Phasor diagrams' fail to qualify? I should make clear that, although the majority of those who accept a double-subscript voltage notation (including Mr. Stefani) favour $V_{ab} \equiv V_a - V_b$, while I consider there are very good reasons for adopting the opposite convention, the latter is not an absolutely essential feature of the system mentioned.—Yours faithfully,

M. G. SCROGGIE
18 Bromley Common, Bromley, Kent
3rd August 1970